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AUTHOR Jacobson, Harvey K.
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ABSTRACT

Information overload, technological change, and financial problems combine with a possible moratorium on growth to increase the need for more rational, systematic, and quantified approaches to information activities in organizations. For communication managers who wish to develop more cost-effective and user-responsive programs, one possible avenue is the application of knowledge about the economic bases of information processing and communication systems. This paper outlines a framework designed to provide concepts beneficial to managers who wish to identify problems, conduct evaluations, and design solutions. The paper reviews and analyzes research literature, concentrating on the area of the economics of information; examines strategies for organizational adjustment; and proposes areas deserving the expanded attention of researchers and managers. (Author)

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Harvey K. Jacobson
The University of Michigan

Abstract

Information overload, technological change and financial problems combine with a possible moratorium on growth to increase the need for more rational, systematic and quantified approaches to information activities in organizations. For communication managers who wish to develop more cost-effective and user-responsive programs one avenue of potential value is the application of knowledge about the economic bases of information processing and communication systems. This paper outlines a framework designed to provide concepts beneficial to managers who wish to identify problems, conduct evaluations and design solutions. The author reviews and analyzes research literature, concentrating on the area of the economics of information; examines strategies for organizational adjustment, and proposes areas deserving the expanded attention of researchers and managers.

(Abstract of a paper prepared for the International Communication Association convention, Portland, April 1976.)

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Toward an Economy of Information
for Organizations
in a Limited-Growth Environment

Harvey K. Jacobson*

The University of Michigan

Ann Arbor, Michigan 48109

A paper prepared for the Organizational Communication division of the
International Communication Association, annual conference at Portland,
Oregon, April 1976

*Dr. Jacobson is Associate Professor of Journalism and Assistant to
the Vice President for University Relations and Development, The
University of Michigan

The post-industrial society is an information society, and the centrality of information creates some new and different problems for the society to manage (Daniel Bell, 1973, p. 467).

Nature of the Problem

The user of information, bombarded with data, needs help. He is limited in the amount of information he can absorb. He is limited in his span of control of the bits of information he can process at one time. Unorganized data are not knowledge; modern communication contains the potential not only to enlighten but also to confuse.

Much of what comes to the attention of the user emanates from organizations. Within these organizations are numbers of individuals who are assigned responsibilities for directing or coordinating communication activities. But the dynamics of unfolding social change often puzzle the communication practitioner, whose daily workload places the focus on specific problems, immediate causes and short-range solutions. An environment increasingly characterized by concerns of no-growth heightens issues of assorted constraints and wise use of

resources. Such an environment also compels organizations to search for principles that can be applied by communication managers to assist organizations in developing strategies for conserving and allocating scarce communication resources. Persons engaged in "the management of decline" (Boulding, 1975) need assistance in facilitating organizational adjustments to a world in which physical, financial and other resources are no longer abundant. The environment of the post-industrial society brings with it a new set of scarcities, not viewed in physical terms as something to be overcome by production, but seen in economic terms measurable in rising costs. One of the costly items is information.

How will organizations respond? As local and planetary demands generate more data, organizations face a major challenge in developing communication strategies responsive to changing needs. They need rational management planning. As data quantity and decision overload increase, organizations lacking in corrective strategies are likely to grow comparatively less responsive because the increase in information needed for discriminating responses will be screened out or ignored (Michael, 1975).

The dialog on no-growth continues. Among the major constraints acting upon information processors are the impacts of technological change and the tightening funding squeeze on public sector activity, which escalate demands for more rational and quantified justification of information activities.

One avenue of potential value to managers who wish to develop more cost-effective and user-responsive communication programs is to apply knowledge about the economic bases of information processing.

Communication and economics scholars have amassed a reservoir of potentially helpful findings but this reservoir needs to be collated, systematized, evaluated and shared. Application of appropriate concepts and methods could help to improve decision-making and policy-setting.

Purpose

The purpose of this paper is to advance strategies for achieving economies of information in organizations by seeking relevant concepts and methods from theory and research literature, especially the area of economics of information.

The paper offers a conceptual umbrella designed to provide concepts beneficial to organizational managers who wish to identify problems, conduct evaluations and design solutions, especially for judging the utility of alternate ways of improving their communication services. The paper also tries to identify critical problems for research and management attention.

Framework and Focus

Economy as used in the title of this paper refers to the management of resources in an organized system to achieve efficient and effective communication. The author prefers to make the distinction between information and data, and recognizes that the literature reviewed in this paper encompasses various definitions of information. Some investigators use it in the technical sense (Shannon and Weaver, 1949): the degree of freedom that exists in a given situation to choose among signals, symbols and messages, or patterns to be transmitted. Others use it in the contextual or semantic sense.

This paper proceeds from the perspective developed by Michael (1975)--that society is "between two ages": between the old world view that equated improvements in the human condition with unlimited growth and a new approach that sees both advantage and necessity in viewing humankind in an ecological mode of relationship with the material universe, other humans and self.* The transition to a steady-state world** is already under way in many organizations and among their constituents and consumers. Education, government, business, labor and other segments of the economy have suffered decline and are searching for adjustment strategies. In growth years a central organizational strategy was fast growth and incremental budgeting; a limited-growth economy puts a premium on prudence, efficiency and cost-cutting. Organizations which appreciate inter-dependence of elements and finiteness of resources enhance their potential for organizational responsiveness.

*It has been pointed out that since it is matter and energy that must be conserved in a balanced ecology, economic growth based on an increasing percentage of information activities, as opposed to material goods, may be consistent with a balanced ecology (Parker, 1973-74). By reducing the matter-energy costs of information processing and increasingly substituting information for energy, reconciliation of economic growth and balanced ecology could perhaps be achieved.

**A number of philosophers, economists, biologists and other scholars have proposed some sort of non-growing state for human society, with many different meanings offered. The most basic definition of the state of global equilibrium is that state in which population and capital are essentially stable, with the forces tending to increase or decrease them in a carefully controlled balance (Meadows, et al., 1972, p. 177.)

The organization is an information-processing unit; one can conceive of the total system as a sort of sandwich, of a data bank on one side and users on the other, interacting via an information processing apparatus (Gerard, 1967, pp. xvi-xix). Data stored in various organizational systems (news services, publications offices, computerized data banks, etc.) are helpful to users only to the extent that those system users possess the communication competencies to create usable or consumable information out of the data. The usefulness of the data stored in the systems is thus a function of the creators and the system users at both the input and output stages. The communication manager plays a key role in allocating scarce information-processing resources, whether the resources are sorting clerks and editors or electronic devices.

The level of performance of communication processing in an organization is critical to the organization's survival. One can view an organization as a social entity which exists to serve the society which supports it. It must adjust to changes over time. Because all living systems operate on the basis of information created from raw-event data, the fundamental condition underlying any living system's continued functioning is information utilization.

Persons who hold communication positions in an organization occupy a role which enables them to improve the effectiveness and efficiency of the communication process. Communication is a valuable resource. It is not a frill. It has utility. It has value. It is not something that is freely available; it has a price.

The conditions of a society of limited-growth increase the importance of the "search for optimality," i.e., using the resources for the collective optimality of users served (Marschak, 1971.) How does the communication manager delegate men and machines to achieve optimal solutions? He needs guidelines.

The focus thus becomes resource allocation. As Marschak says (p.56), "The economic problem of organizations is that of allocating numerous kinds of tasks, symbol manipulating as well as physical, to numerous transformers, arranged in a complex yet efficient network."

Method

The paper is based on the author's review and analysis of research literature. The main literature searched was economics of information literature, especially those studies now emerging as a body of literature in economics and information systems, as organized by researchers in information and library science. Areas also drawn from were futures research and social psychology. Analysis is also based on experience obtained from a long time interest in the application of research to practical decisions, and conclusions drawn from problems encountered and findings obtained in a two-year program evaluation of communication units of one of the nation's largest universities (Jacobson, 1975.)

Analysis

Comments on the Literature. The "Economics of Information" is a young field, but the literature reflects considerable progress and offers assorted areas of potential application.

One measure of progress is the fact that Machlup's pioneering work (1962) in the description of the size and scope of the information industry in the United States is in the process of updating. In 1974 Machlup began preparation of a new version of this classic analysis, which interpreted 1958 data. Other measures of progress are the bibliographies being produced, reflecting the domain included in the territory referred to as economics of information.

Olsen (1972), who classified the literature into 12 categories ranging from economic theory to operations research, found that the major bodies of literature which report on the economics of information produce quite different types of literature pertinent to the topic. The economics literature tends to develop concepts and tools, while the information literature describes structural factors and data on substantive aspects, although usually in a hortative mode.

Cooper's research review (1973) concentrated on a description of various institutions that produce and disseminate information, the resources and constraints affecting the production and distribution process, and methodologies available for making resource allocations in libraries and information retrieval systems.

Reflective of the approach of the bibliographers is that of Cooper, who describes research in economics of information as:

An attempt to examine in economic terms the entire chain of events that begins with the creation of new information by researchers and inventors; continues through the dissemination of information by educators, the communications media, computers and information services; and finally ends with the processing, or use, of information by individuals.

The analysis of the economics of information is concerned with the resources available to promote the process and the constraints that limit it. And since there is obviously competition for the use of funds, the economic analysis of information must consider how funds can best be allocated to maximize the overall benefit to society as well as the effectiveness to individual information producers and users (Cooper, p.5).

The literature is extremely diffuse, with minimal cross-referencing between the economics community and information community. Such a situation is hardly surprising considering the emerging stage of development of the field, which only recently has been treated as a discrete topic for study by either community. However, various approaches

have considerable value and merit further attention and inquiry. Thus it seems worthwhile to discuss certain areas that emerge as leading candidates for an agenda deserving the attention of the communication manager and the researcher.

Critical Concepts. The communication manager should:

Understand processes for adjusting to overload. Communication managers and their organizations receive much more data than they can absorb. Failing to respond to information overload can lead to unworkability or inaction. It is important for managers to understand the processes of adjusting to overload.

Miller (1965) has proposed various adjustment mechanisms. These mechanisms apply not only to organizations, but other living systems: cells, organs, organisms, groups, societies and supranational systems. The mechanisms are: omission, failing to transmit certain randomly distributed signals; error, incorrectly transmitting certain randomly distributed signals; queuing, delaying transmission of a sequence of signals which is temporarily stored; filtering, giving priority in processing to certain classes of signals; abstracting, processing information with less than complete detail; multiple channels, simultaneously transmitting information over two or more parallel channels; escape, acting to cut off information input; and chunking, transmitting meaningful information in organized chunks of symbols rather than symbol by symbol.

Many information systems are designed on the assumption that the critical deficiency under which most managers operate is the lack of relevant information. However, they suffer even more from an overabundance of irrelevant information (Ackoff, 1971). The conse-

quences of changing the emphasis of an information system from supplying relevant information to eliminating irrelevant information are considerable. If one is preoccupied with supplying relevant information, attention is almost exclusively given to the generation, storage, and retrieval of information. This approach places emphasis on constructing data banks, coding, indexing, updating files and access languages. The ideal which has emerged from such an orientation is an infinite pool of data into which a manager can reach to pull out any information he wants. An alternative approach views the manager's processing problem primarily, but not exclusively, as one that arises from an overabundance of irrelevant information, most of which was not solicited. The functions which merit major attention in this approach are filtering and condensation (abstracting).

Refine the filtering function. Chances for achieving an economy of information increase if the manager reduces the transmission-belt function and increases the synthesis function of the system he manages. An information processing system, which may be human, automated, or both, will reduce the net demand on the rest of the organization's attention only if it absorbs more information previously received by others than it produces. A crucial question is how much information it will allow to be withheld from the attention of other parts of the system (Greenberger, 1971, page 55).

Many researchers have investigated the filtering function. Bodies of literature with considerable potential for application here are those which treat gatekeeping (Dimmick, 1974) and agenda-setting (McCombs and Shaw, 1972.) Another fruitful avenue needing continued development is that of perceptual and conceptual coding. Inadequate codes prevent the

processing of communication content. Cognitive development is the formation of economic codes that cut away noise. Biggs (1971), who defines codes as "any means of organizing information," advances a cybernetic model which includes an "economy program" for compressing and encoding information in units that fit into the available channel capacity and that are sufficient to lead to problem solving.

Improve the ability to abstract. The processing system must listen and think more than it speaks; it must be a condenser. The languages of signs, sounds, and motions provide methods of coding vast amounts of information in a compact manner. A shared experience can be called to view at a glance by those who shared it.

Newspaper editors are discovering that the "tight newshole" brought on by the newsprint shortage can be a blessing in disguise. It forces examination of content, tighter writing, and more careful use of the printed page. It also serves as a reminder of the importance of visuals and graphics. Examples of attempts to abstract: corporate symbols, Bicentennial Minutes, trigger films. Suggestions for improving sensitivity to interpretation and use of nonverbal codes are presented in Harrison's (1974) review of research findings.

Devote increasing attention to demand analysis. The manager should direct programs which are user-responsive. Studies of information activity have focused almost exclusively on the supply side of economic analysis, showing much more interest in costs (to producers) than benefits (to users). In modern culture the emphasis in "knowing" shifts from the storage or actual physical possession of information to the process of using or having access to it. Computers await the intelligent use of the manager, but they also can be moronic robots

accepting, storing and spewing out vast quantities of data. What is needed is respect for the scarcity of attention of the recipients of information. In a data-rich world the wealth of data means a dearth of something else: the attention of recipients. The manager seeks solutions for allocating that attention efficiently among the overabundance of sources that might consume it. One way proposed for measuring how much scarce-resource a message consumes is by noting how much time the recipient spends on it (Simon, 1971).

If one accepts attention-conservation for the receiver as an underlying design principle, it follows naturally that the manager should give increased attention to user or audience orientation as he designs or redesigns his communication system.

Forthcoming is the home information center or "information utility," which places the receiver of information in the commanding position. Instead of taking what mass media reporters and editors have packaged for him, the receiver orders what he wants. As control over the receiver's environment decreases, sensitivity to receiver interests and motivations must increase. The communication manager must devote more time to assessing attitudes and opinions, identifying the community of users and keeping a data bank on their needs. Selective dissemination services, already used in many agencies, possess potential for reducing the user's need to wade through masses of material in order to find the relatively small amount of information he really requires. More attention should probably be given to "quasi-mass communication," whose channels concentrate on infusion rather than diffusion.

Emphasis on a user orientation suggest increasing attention to demand analysis (Cooper, 1973), marketing and attitude surveys, and consumer information processing (Ray and Ward, 1975). A lesson can be learned from the advertising and marketing fraternities, which have found that when fewer products are produced it is more important than ever to match the product to the individual. Managers thus require more data about the wants and needs, and problems and expectations, of diverse elements of the population. A prime example of assessing receiver needs and designing a program to meet them is Operation Gap-Stop, the educational soap opera which brought socially ameliorative information to the "information poor" in Denver's public housing (Mendelsohn, 1968).

Study the applicability of cost-analytic techniques of evaluation.

The manager should seek to determine evaluation strategies that are most appropriate for his programs.

Cost-analytic techniques include cost-effectiveness, cost-benefits and operations analysis. Problems of costing information systems have been discussed by Marron (1969), who reviews some reasons why standard cost accounting procedures as used in conventional business applications cannot be applied totally to services of communication centers. While costing procedures for information products and services are generally lacking, techniques are gradually being developed, applied and published, e.g., cost data on the MEDLARS operation from the National Library of Medicine, and costs of indexing and abstracting. Lancaster (1971) reviews this progress, clarifies distinctions between cost-effectiveness analysis and cost-benefits analysis as applied to information systems, and examines some factors influencing cost-effectiveness. Software analyses study factors such as acquisition and storage, identification 15 and location, and presentation, while hardware analyses typically

concern factors such as optimum production capacity of equipment, maintenance record, turnaround time, estimated volume of work to be handled and purchase or leasing costs.

Operations research attempts to provide data on alternative ways of conducting program activities in an organization: assignment of personnel, scheduling, and choosing among alternative programs. Changing information technology alone raises numerous questions for managerial answers. Which media or media combinations should be chosen? Unit costs of computer information processing are decreasing faster than costs of conventional media and deserve careful consideration. Many managers wonder about the feasibility and advisability of microforms, electro-optical output images and other alternatives. Observers have noted that problems of library organizations will steadily become more urgent not only because of budgetary and space considerations but also because the high acid content of paper used for books during the past century has condemned them to a short life; the economics of preservation are closely allied with the economics of dissemination.

Other techniques of evaluation may also be appropriate, such as monitoring techniques (administrative audits, time and motion studies) and social research techniques (experiments, surveys, case studies). There is growing interest in measuring effectiveness of programs. Program evaluations have been applied with considerable sophistication in medicine and other fields (Suchman, 1967), and with increasing sophistication in education (Anderson, 1974). Gains have been made in evaluating information systems (King and Bryant, 1971) and progress has been registered in the development and testing of internal communi-

cation audit instruments and methodologies (Wood, Perrill and Buley, 1975). Diagnostic procedures for analyzing and improving written communication in organizations also have been outlined (Vardaman, Halterman and Vardaman, 1970).

Conclusions

As we move into an era of larger and larger supplies of data and decreasing supplies of certain resources, communication managers can play a key role in solving social-clinical problems by designing organizational strategies for a data-rich world. The answer lies less in shaving microseconds off processing times and more in consultation and planning which assist people in processing data into better and more relevant information.

A key unsolved problem is how to measure the contextual or semantic information content of a message in a social system. One of the most glaring deficiencies in present knowledge occurs in the measurement area. Measurement progress should be assisted by increased effort to apply theory and research, and to merge bodies of relevant literature. Reviewing the design, testing and evaluation of information storage and retrieval systems, Krevitt and Griffith (1973, p. 4) lament the separation of the "evaluation" literature and the "user" literature. Olsen (1972, p. 5) is distressed that "the information community is generally lacking in understanding of economics, while the economists fail to understand information problems." Add to this the need to integrate research findings from mass communication and social psychology, and one grows to appreciate the large assignment ahead.

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